Claims

1, A damper having an adjustable spring rate, comprising:

a piston having an axis, an outer surface, and opposing ends;

elastomeric seals in sealing contact with the outer surface of the piston, the seals being coaxial with the piston and limiting movement of the piston to a path along the axis of the piston, the seals also defining fluid chambers adjacent the ends of the piston;

a primary passage communicating the fluid chambers; and

a selectively switchable valve for controlling a flow of fluid from one of the chambers to another of the chambers through the primary passage; and wherein

when the flow of fluid through the primary passage is permitted, movement of the piston is resisted by a first spring rate due to a shear force required to cause shear deflection of the seals; and

when the flow of fluid through the primary passage is restricted, movement of the piston is resisted by a second spring rate due to a fluid force required to cause bulging deflection of the seals.

2. The damper according to claim 1, wherein the elastomeric seals are formed of layers of an elastomeric material and a rigid, non-elastomeric material.

3. The damper according to claim 1, wherein the damping valve is located within the primary passage.

4. The damper according to claim 1, wherein the damping valve is electrically operated.

5. The damper according to claim 1, wherein the primary passage is located within the piston.

6. The damper according to claim 1, further comprising:

a secondary passage communicating the fluid chambers.

7. The damper according to claim 6, wherein the secondary passage is located within the piston.

8. The damper according to claim 1, further comprising:

a bypass passage for limiting the pressure imbalance between the fluid chambers.

9. The damper according to claim 8, wherein the bypass passage is located within the piston.

10 The damper according to claim 8, further comprising:

a bypass valve located within the bypass passage.

11. A damper providing for selection between at least two spring rates, the damper providing:

a piston having an axis, an outer surface, and opposing ends;

elastomeric seals in sealing contact with the outer surface of the piston, the seals being coaxial with the piston and limiting movement of the piston to a path along the axis of the piston, the seals also defining fluid chambers adjacent the ends of the piston;

a primary passage communicating the fluid chambers;

a secondary passage communicating the fluid chambers; and

a selectively switchable valve for controlling a flow of fluid from one of the chambers to another of the chambers through the primary passage; and wherein

when the flow of fluid through the primary passage is permitted, movement of the piston is resisted by a first spring rate due to a shear force required to cause shear deflection of the seals; and

when the flow of fluid through the primary passage is restricted, movement of the piston is resisted by a second spring rate due to a fluid force required to cause bulging deflection of the seals.

12. The damper according to claim 11, wherein the elastomeric seals are formed of layers of an elastomeric material and a rigid, non-elastomeric material.

13. The damper according to claim 11, wherein the damping valve is located within the primary passage.

14. The damper according to claim 11, wherein the damping valve is electrically operated.

15. The damper according to claim 11, wherein the primary passage is located within the piston.

16. The damper according to claim 11, wherein the secondary passage is located within the piston.

17. The damper according to claim 11, further comprising:

a bypass passage for limiting the pressure imbalance between the fluid chambers.

18. The damper according to claim 17, wherein the bypass passage is located within the piston.

19 The damper according to claim 17, further comprising:

a bypass valve located within the bypass passage.

20. A method for providing multiple spring rates within a damper, the method comprising the steps of:

sealingly engaging opposite ends of a piston with elastomeric seals to form fluid chambers;

communicating the fluid chambers with a passage;

selectively controlling an amount of fluid flow through the passage, such that movement of the piston is resisted by a total spring rate, which is the sum of a first spring rate due to a shear force required to cause shear deflection of the seals and a second spring rate due to a force required to cause bulging deflection of the seals by fluid pressure induced by the movement of the piston.